Notes & Queries

J. B. F. asks: What is the best process of cleaning and tinning old copper saucepans?

J. W. S. asks: Is there any substance which, when enclosed in a glass tube or bottle, will give a continuous light, brighter than phosphorus?

T. E. asks: How can I prepare gelatin for heliotype printing? What are the materials and proportions for making the inking rollers?

A. M. asks: How is the solution used in electroplating with tin, described on page 71 of the present volume, prepared?

W. A. B. asks: How can I restore ivory to its natural color? What is the composition of the cement with which knives are fastened in the handles?

H. R. E. asks: Can articles be coated with steel by an electrotype battery, and how?

P. L. B. asks: What will keep cherry boards from warping?

G. P. asks: 1. How can I make oiled silk? 2. How can I make a waterproof varnish for muslin bags, which will not crack when the bags are folded up?

B. I. L. asks: 1. Of what substance are Mr. Rogers' groups of statuary composed? 2. Is there a book which describes the tools and *modus operandi* used in making such statuary?

E. says: I have several hundred horse power running to waste three miles distant from a manufactory where I require thirty or forty horse power. Can you advise me how it is practicable to transmit the water power over that three miles to drive the manufactory?

E. asks: Is there any value in a miner's compass? "I bought one, and when new, the north pole was readily influenced by the presence of metallic iron. It was sent 300 miles by rail, and lost its attraction for metallic iron; but when carried into a shaft of limonite ore, the south end points down and the north end up, at an angle of about 70°. Outside the mine, the south pole dips about 10°, and at other places 20°. Why does the south pole dip instead of the north pole? Is the needle of any practical value in prospecting? What are the difficulties in using it, and how are they to be guarded against?"

Answers to Correspondents

A. F. A. says: Please give a rule for calculating the power of a tube boiler. The fire is under the boiler and comes through the tubes. Answer: Calculating the heating surface in square feet, and dividing by 15, will give you the horse power, approximately.

J. W. asks: What are the component parts of nitro-glycerin, and the relative amounts by weight of each ingredient? Answer: Into a mixture of four and two thirds pounds of concentrated sulphuric acid and two and one third pounds of concentrated nitric acid, pour one pound of glycerin and you have the terrible explosive agent, nitro-glycerin.

Z. M. P. K. asks: What cheap chemical preparation will dissolve and clean earthen pipe sewers from a tough sediment adhering thereto, supposed to be caused by grease and soap suds from washing dishes, etc.? Answer: Try washing with milk of lime, or strong lime water.

W. K. M. asks if apple pomace distributed round a well of water would cause an engine which uses the water to rust or cut. The engine is sometimes found to be quite rusty in the morning. Answer: We do not think the result you speak of is produced by apple pomace, but more probably by dampness in the atmosphere.

W. P. B. asks: What is the comparative efficiency, for draft, of brick and iron chimneys, also how much difference will the form, square or round, make? What is the rule for size and hight of chimneys, computed from the boiler? Can you mention any cheap work giving reliable information on kindred subjects? Answer: A round chimney of brick is probably the best. No. 1 of Van Nostrand's "Scientific Series" will probably give you the desired information.

G. T. L. asks: In working steam expansively in the ordinary reciprocating engine, does it make any difference whether the port is left wide open during the first part of the stroke and entirely closed during the remainder, or whether the port is but partially open during the entire stroke, the width of the opening, in the latter case, being of course regulated by the desired degree of expansion? Answer: It is much more economical to work the engine as mentioned in the first case.

J. B. M. says: I have an engine that requires 40 lbs. pressure, but sometimes I have extra heavy work and have to run it at 60 lbs. Will it take any more fuel to keep the pressure at 60 lbs. all the time, provided that there is no escape of steam through the safety valve? Answer: Theoretically, it takes scarcely any more fuel to make steam of 60 lbs. pressure than it does of 40 lbs.; but in practice, there is a noticeable difference in the amount of consumption in the two cases. It will be ordinarily more economical, however, to carry steam at the higher of the two pressures.

J. S. M. asks for an easy rule for setting a slide valve with a link motion? How would you set a cut-off, made of two plates sliding on the back of the slide valve, with a right and a left hand double thread on the stem, they being drawn together by a wheel on the top of the stem? How can I set out the rings of the steam piston? How shall I key up the connections with the crank pin and cross heads? How can I set the boxes to the other bearings, especially the thrust bearing? What is the best thing to prevent foaming or to prevent the water from being drawn over from the boiler into the engine? Is it a good plan to give a boiler plenty of steam room, so that the steam may clear itself of the water that is apt to rise with it? Answer: We are glad to receive a letter containing such intelligent questions; but our correspondent, without perhaps being aware of it, has made inquiries that could only be answered by a lengthy treatise on marine engines. He must study such things for himself; and while he will find many valuable hints in our paper, he can only master the subject by diligently reading the best textbooks, and carefully investigating the best practice.

T. T. says: We have a well about 40 feet from a pond, and want to lay a one inch iron pipe under ground, from pond to well: how can we do this without draining the pond? We want to lay it about 4 or 5 feet below the surface of the water. Answer: Perhaps you had better lay the pipe in another manner. If the well is below the pond, a siphon will answer very well, and can be easily applied.

B. M. asks: How can I mix chalk or other precipitate with either alcohol or water, so that there will be no sediment at the bottom? By what process can it be brought to a creamy appearance? Answer: The nature of a precipitate is insolubility. Chalk is insoluble in water or alcohol, and therefore precipitates or falls to the bottom as a sediment. You cannot change the chemical properties of chalk in this respect. You can only keep up a creamy appearance of a mixture of chalk and water by frequent stirring.

H. M. B. asks: What is the best mode of extracting, from linen or clothing, the stains produced by the tincture of muriate of iron, after they have been washed? Answer: Soak in solution of oxalic acid, and wash thoroughly. Oxalic acid is poisonous when swallowed.

H. J. B. Jr. asks our opinion of a system of hydraulic rams for propelling water for extinguishing fires. Answer: Probably when steam is not used in a building, this would be a good arrangement. But when steam is available, a steam pump could be made more effective and quicker in its operation.

D. A. I. asks: Can you inform me of the best method of coating paper with a coloring matter, such as an aniline dye, the object being to have the coating as thick as possible without scaling off readily? The color at the same time should be soluble in water. I have tried common gum arabic, but, while it prevents scaling off, it is insoluble in water, and is very difficult to work. Answer: Try a very weak solution of gum arabic. This has very slight consistency, and, while preventing scaling, cannot be difficult to work.

A. M. R. asks for information concerning the most recent process of making malleable iron castings, on a large and small scale. Answer: A process of making malleable iron castings is to heat the castings to redness while imbedded in powdered chalk or charcoal, or oxide of iron (hematite, for instance), so as to protect from the action of the air, and decarbonize the cast iron. See Osborn's "Metallurgy of Iron and Steel," and "The Manufacture of Steel," by Grüner.

J. T. B. says: A friend and I have a question *sub judice*. He contends that, in the construction of an ear trumpet, it is of great importance that the material be such that it will increase the sound which it transmits, such as light metal or other material capable of sonorous vibrations while I, on the contrary, maintain that the whole design of the ear trumpet is for the purpose of collecting and transmitting or conducting the sound already produced, and that it should be constructed in bell form merely to collect the sound waves and thus make a direct impression on the *membrana tympani* with greater force. I contend that the form has more to do, with its effectiveness as an aid to hearing, than the material of which it is constructed, and that it being sonorous or capable of vibration does not increase the sound or make it more easily heard. Which is right? Answer: It is generally considered that it makes very little difference of what material the instrument is constructed, or what is its form, provided only that the outer opening is greater than that which enters the ear. The effect of this is to transmit the sound vibrations to portions of air continually growing smaller, thus increasing the intensity, as the vibrations approach the ear.

R. H. asks: 1. In which case has a vessel the greatest buoyancy, when filled with atmospheric air, with compressed air, or when exhausted of air altogether? 2. What is the relative buoyancy? 3. Give a rule for finding the weight which a given quantity of air will support in sea or fresh water. 4. What is the best shape for buoys? 5. What amount of horse power would be required to move a horizontal column of water 3 feet diameter and 30 feet long at the rate of 20 miles an hour, the column discharging horizontally against an open body of water 3 feet below the surface? 6. What resistance would be offered by the open body of water? Answers: 1. When exhausted. 2. Common atmospheric air weighs about ·0765 pounds per cubic foot, compressed air at a pressure of two atmospheres weighs twice as much, and so on. 3. Weight which can be supported by a floating body is equal to the weight of the displaced water. 4. They are usually made can shaped. 5 and 6. We cannot answer these questions without some further particulars being given. If, as we suppose, the questions are asked in reference to propulsion by a water jet, we must refer you to some good treatise on the subject.

T. R. B. asks how to get the exact radius for a link for an engine? Answer: We think you will find full and correct information on this subject in "Link and Valve Motions," by W. S. Auchincloss.

M. H. asks: Will linseed oil mixed with slaked lime do to paint old buildings with? Answer: Linseed oil and slaked lime when mixed together will form a soapy compound, not suitable, we should imagine, for a paint. You want for a body some substance that will not chemically combine with the oil, such as red oxide of iron or red ocher, a favorite color in some localities. You can shade down with whiting or fine chalk.

C. P. asks for the best method of restoring the colors of faded carpets, and removing grease spots. Answer: You can remove grease spots from a carpet by soaking it with benzine or naphtha, by means of a rag. We know of no way to restore the faded colors in a carpet.

W. B. J. asks: What material must I use to make a tough elastic mold for casting center flowers in plaster of Paris? Answer: Use a mold of gelatin, and a cold setting plaster.

C. R. C. asks: How can I make powdered soapstone perfectly white? Answer: The coloring matter of soapstone is due to some metallic oxide in its composition. You might try the action of dilute oil of vitriol upon it in a very finely powdered condition.

G. B. asks: What salts and gums are the most affected by the weather? Answer: The most deliquescent salt, or one that attracts moisture the most, is the chloride of calcium. The gums, on the contrary, have generally the property of parting with their combined water, and drying when exposed to the air.

S. C. A. says: In Colorado the atmosphere is clear and dry. Persons on their arrival there find it very difficult to perform any active labor on account of the difficulty in breathing, until they become acclimated. This is more noticeable in sickly persons, or persons with weak lungs. Is it to be accounted for by there being a less per centage of oxygen in this pure, dry atmosphere? 2. Must the lungs expand to allow one to inhale sufficient air to obtain the required amount of substance to sustain life? Answer: You are right in saying that oxygen is essential to the lives of animals, and that the lungs are provided for the purpose of absorbing it, thus oxydizing the blood and keeping up the standard of animal heat necessary to life. On the mountain hights of Colorado, the air is less dense than that at the sea level, and consequently, bulk for bulk, contains less oxygen. It follows from this fact that, where you live, the lungs must inhale more air in a given time, in order to obtain the required amount of oxygen, and consequently one must breathe faster. It would naturally take some time for the lungs of persons who are accustomed to breathe dense air to become accustomed to a comparatively rarified atmosphere, and this change of air would affect sickly persons or those with weak lungs more than those with sound ones.

J. W. R. asks: By what process can I obtain the greatest amount of carbon? Answer: That depends upon the kind of carbon wanted. Charcoal is one kind, and a very compact variety forms sometimes in gas retorts. Lampblack is nearly pure carbon.

J. F. W. asks: What metal is the best conductor of electricity? Answer: Silver is the best conductor of heat and electricity known.

S. T. B. asks: What battery power will it require to heat red hot a platinum sheet, 5 inches square and the thickness of a sheet of writing paper? Answer: Supposing the platinum to be the one hundredth of an inch thick, about seventy five cups of the largest size of Bunsen's battery, all well connected and in active operation, will be needed.

G. A. asks for a simple method, suitable for class illustration, of producing a current of electricity by light, to show the relations of heat, light, electricity, and chemical force. Answer: Adjust a prism so as to get a well defined polar spectrum, bring the violet rays to a focus on the eye of a fine cambric needle made so hard that it will scratch glass; this will magnetize the needle, proving that light will produce magnetism, by which a current of electricity may be induced in a small coil of very fine wire connected with the binding posts of a sensitive galvanometer; a slight movement of the galvanometer needle each time the magnetized cambric needle is caused to enter the coil, and a movement in the opposite direction when it is withdrawn, delicately prove the correlation of light to magnetism and electricity.

H. W. S. Jr.—In the compound engine, the use of the steam by a second cylinder is secured in a manner better than that which you propose.

F. J. S. says: 1. Is the "Science Record" an illustrated work? 2. What is the approved theory of the magnetic force which controls the needle of a compass? 3. What is the variation of the compass at New York? 4. What is the cause of the variation which the magnetic needle makes with the true meridian? 5. How is lodestone obtained? Answers: 1. Yes. 2. It is quite reasonable to regard the earth as an immense magnet, whose south pole is at its north geographical pole, and consequently attracts the north pole of the needle. 3. About two degrees west of north; the variation is not fixed, and is more or less every day in the year, and frequently several times in a day. 4. It is supposed to be caused by local electric action. 5. It is a valuable lower oxide of iron, and is found in the ground as an ore.

D. M. B.—The machine you describe in your communication does not seem to us to embody any novel features. The fact that a heavy body, when put in motion, requires considerable force to stop it is by no means new. The announcement that you get rid of the resistance is scarcely worthy of comment, as it amounts to saying that you have created power. You must excuse us for not being willing to give up what you are pleased to call the old theory of the lever. If your machine really destroyed resistance, it would accomplish this equally well whether running fast or slow; and in such an impossible machine, a pound weight, hung on a point where the power is applied, would, in falling a foot, raise something more than a pound (suspended there to represent the resistance) through the same space.

E. T. asks: Does the burning of coke affect the iron of a boiler more than coal? Answer: We think not.

D. K. S. asks: Will corn meal put into a steam boiler injure the iron? I find after 6 months use of it (put in to stop a leak) that my boiler is as clean and free from scale as when new. Answer: We think not.

W. H. F. asks: Are any oscillating engines made in this country with cut-off valves? As far as I can learn, they are all made to open and close their ports by the oscillation of the cylinder, and are therefore invariable in their action. I wish to procure, if possible, two oscillators wherein I can regulate the steam as with a link motion. Answer: We have seen such engines as you describe, but it would probably be necessary for you to have them built to order, as we do not think they are regularly in the market.

J. J. R. asks: For a small steam yacht, say 20 or 30 feet long and 5 or 6 feet beam, which is the steadier, fastest and cheaper, as far as machinery is concerned, a side wheel or propeller? Where space is not so much an object as speed and steadiness, which is preferable, an upright or horizontal engine and boiler? Answer: The side wheel will be the steadier, and the screw propeller the faster and cheaper. For such a small boat, a horizontal boiler is hardly practicable, and the upright boiler can be made of large diameter and low, so as not to affect the steadiness of the little steamer.

T. H. says: The English plan of sounding in deep water is to attach a block to one of the yard arms; then another block is secured to the end of a rope which is rove through the yard block and secured to the main rail by elastics, the second block being hauled close up to the yard block. Then the sounding line is rove through this second block and the sinking weight and grapnel attached. The line is marked with a conspicuous mark at each hundred fathoms and told off by the officer in charge as the line runs out. A large number of pins are placed in the main rail on which the line is carefully placed in coils, and a man is detailed to to see that the line runs off clear. A small engine connected with a winch is employed to haul in the line. Two or three turns are taken around the winch head with the line, and held by an experienced man who allows it to surge whenever an overstrain comes on the line by the ship's motion; and yet, with all possible care the line is often parted and lost. 1. What proportion of the strain of the line is due to pressure? 2. If a round spar of white pine, 10 feet long and 6 inches diameter, were attached to a weight sufficient to sink it rapidly to the bottom in 5,000 fathoms water, weight detaching itself on striking bottom, would the spar have sufficient buoyancy to return rapidly to the surface with 10 pounds weight attached? 3. To what size would the spar be reduced by the pressure? 4. Would it retain its original weight under the pressure? 5. Is there any agent that can be employed that will return rapidly to the surface with 10 pounds weight attached from 5,000 fathoms depth, which will not require more than 100 pounds to each 1,000 fathoms to sink it rapidly? Answers: We presume that the strain on the line is due to its own weight and the friction of the water, the weight of the line being greatly increased by its becoming soaked. If the white pine spar were thoroughly dried, it is doubtful if it would be sensibly compressed, as it would readily absorb water, until all its pores were filled. It would be impossible to tell without experiment how much water it would absorb, under the pressure to which it would be exposed, but probably not more than it contains when just filled—in which case it would weigh from 30 to 33 pounds per cubic foot. As the weight of the displaced water would be something more than 64 pounds per cubic foot, it is evident that the spar would rapidly rise to the surface. If it could be coated with some preparation to exclude water, its weight would be only about 25 pounds per cubic foot, and it would rise more rapidly. Perhaps some of our readers have made experiments, to find how much the weight of a wooden float is increased when it is submerged; and if so, we would be glad to hear from them. It might be better, instead of using a spar, to sink a bag or a telescopic cylinder which contains a mixture that would form gas of considerable pressure when the weight was detached. The effect of this would be that the bag would be inflated, or the cylinder lengthened, and in either case, as the bulk of the submerged body would be largely increased while its weight remained the same, it would rise rapidly. The advantage of this arrangement would be that it could be submerged by a small weight, in comparison with that required for a body with constant volume.

F. M. H. asks: 1. What sized pipe will I require to convey steam 600 feet from a two flue boiler 42 inches diameter by 20 feet long to a four horse power engine, the pipe not to be coated? If the pipe be coated, what per centage of steam will be saved? 2. Do we get as much power with a turbine near the top of the penstock as at the bottom, the latter being full of water when started? The turbine is supposed to run by suction, as the water flows through the turbine and keeps the penstock full. 3. Is it practicable to bore artesain wells to run water engines? At what depth is water usually found where springs are numerous? Answers 1. About 1½ inches in diameter. By properly coating the pipe, you will effect a great saving, probably more than 25 per cent. 2. We would recommend the wheel to be placed as low down as is convenient. 3. Water can be obtained in some localities, by digging down a few feet; but borings for artesian wells must generally be made to a considerable depth, in any locality. It is not usual, however, to construct them when there is plenty of water close to the surface. The boring machinery can be driven by water wheels. There are two artesian wells, close together, in the city of Chicago, and the machinery for boring the second one was driven by a wheel propelled by water from the first.

J. C. S. would like to know the maximum power transmitted under following circumstances. "Our driving pulley is 8 x 24, and runs at rate of 130 revolutions per minute; the driven pulley is 8 x 24 and is distanced from driving pulley 28 feet. Belt runs nearly horizontally. The day it was put on (as tight as could be, with stretcher) 12 inches was cut out in consequence of its becoming too slack; next day 22 more inches was cut out; and today the belt is slack. A rule laid down by your paper gave 11,000 feet per minute to the inch for a horse power, making this belt about 5 horse power; according to a test by a practical man with a dynamometer, as described in the SCIENTIFIC AMERICAN, it would produce over 11 horse power. If the belt is strong enough and does not slip, this is not a very good rule for calculating its power." Answer: The rule referred to probably gives average results, and not the maximum amount of the power that can be transmitted by a belt. We shall be glad to hear of reliable tests on the subject; and if we receive enough data, we will correct the formula.

W. B. E. asks: Why will not direct acting steam pumps work with single slide valve alone, without having auxiliary piston and tappet valves to move the slide valve? Answer: We believe the first direct acting steam pump was made as you describe; but it is found easier to regulate the stroke of the pump by using tappets and an auxiliary piston, because in this case the motion of the piston is reversed with little expenditure of power.

W. J. R. asks: 1. What horse power, theoretically, ought one pound of good bituminous coal to furnish? 2. Given a mine in which the air travels two miles through gangways 8 x 6 feet, with difference in elevation of pit mouths 50 feet, increased 50 feet by furnace stack: Supposing that you can burn, theoretically, one tun of good bituminous coal per day, what is the greatest velocity and amount of air you can draw through in a day? Answers: 1. Theoretically, every pound of good bituminous coal burned per hour would develope about 5¾ horse power, if its whole effect were realized. 2. You do not send enough data to enable us to answer this question.

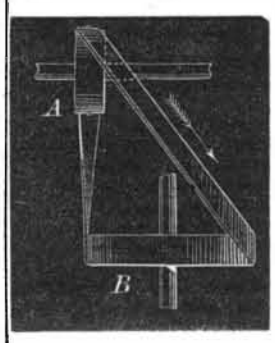
W. B. E. says: Your answer in regard to two pumps discharging into one pipe was incorrect. To increase the quantity of fluid discharged, you must increase the pressure. Answer: We have already re-explained this matter, and until we see it clearly proved that a small steam fire engine throws as much water as one double the size, with same steam pressure and number of strokes, we do not feel inclined to alter our opinion.

H. A. D. asks: 1. In turning a curve, does one wheel of a locomotive turn any faster than the other, and if so, how, both being secured to the same axle? 2. Can a locomotive with two driving wheels, connected by the rod, travel as a locomotive with only one driver? Answers: 1. No. 2. Yes, if we understand the question.

A. P. Y. asks: Can a boat sail faster on a tack, that is, going against the wind, than when going directly before the wind, the velocity of the breeze being the same in both cases? Answer: A sailing vessel, under some circumstances, goes faster on a tack than before the wind. You will find an article on the subject, on page 177 of our volume XXVIII.

B. A. S. asks: 1. What are the methods of ascertaining where iron ore is to be found other than digging? What peculiarities of soil, or other surface indications, are there, which denote the presence of iron ore, and what indications are incompatible with it? 2. Can a miner's or dip needle be relied upon, and can any one use one? 3. Is your paper as good as any to advertise an ore bed for sale? Answers: 1. Consult some reliable work on geology. 2. The miner's needle is chiefly employed to locate veins in mines. 3. We think so. See page 141 of this issue.

T. O'N. asks: Is the arrangement shown in the diagram the proper one for a belt from A to drive a shaft on B at a right angle, both shafts being horizontal, and one about twenty feet above the other? When driving a horizontal shaft, from an upright one, will the pulleys have to be arranged in the same way, and will the belt lead from the driver to the driven, as in the case of the two horizontal shafts? Answer: When transmitting power with a quarter turn belt from one horizontal shaft to another, also horizontal, at right angles to it, guide pulleys are generally employed. When one shaft is horizontal, and the other vertical, the arrangement shown in your sketch will answer, if there is sufficient distance between centers.



E. W. H. asks: 1. What is the fireproof composition used in the manufacture of safes? 2. Would not the same material placed on the outside of and around a steam boiler confine all the heat to the inside of the boiler? 3. Are these non-conducting compounds patented? 4. Are the materials expensive? Answers: 1. Safe fillings are generally made of gypsum, alum, hydraulic cement. 2. No, not all. But the use of a jacket of non-conducting material saves much fuel. 3. There are several patents. 4. No.

W. A. M.—The reason why your plan will not work is the same as would be assigned in case a solid weight were used to sink the receiver, instead of the weight of the compressed air.

C. J. B. asks: How can I regenerate ink that has been frozen? Answer: Prussiate of potash will not regenerate frozen ink, though it will bring out writing written with such ink. When potassium ferrocyanide or yellow prussiate of potash is added to a solution of ink, iron ferrocyanide or prussian blue is formed. We know of no method to regenerate frozen ink, its pale color after freezing being due to the decomposition of the organic matter (galls) contained in it.

G. W. B. asks: How can ordinary dark brown maple sugar be clarified so as to be made of a much lighter shade? 2. How can I tan deer skins so they would be suitable to make up into hunting jackets, leggings, etc.? Answers: 1. Dissolve the sugar in water, add whites of eggs to the solution; heat to the boiling point; and skim off, while boiling, the impurities from the top. While still hot, filter through recently burnt animal charcoal (bone black). Boil again to the crystallizing point, and then run off into molds, etc. 2. Soak the skins in lime water, and cleanse as perfectly as possible. Then soak in dilute oil of vitriol to open the pores of the skin. Then soak in an infusion of oak bark or tannin until sufficiently tanned.

E. E. G. asks: How can double sulphate of nickel and ammonia be made from the sulphate, for a plating solution? Answer: Add aqueous strong ammonia to a warm (not hot) saturated solution of nickel sulphate, cool, evaporate in a vacuum or without boiling, and collect the light blue crystals that form.

C. R. C. asks: Can rubber be made pure white, so as to receive a good polish and not altogether lose its elasticity? What work treats upon the subject of rubber? Answer: Crude commercial rubber is colored dark by the smoke of the fire used in drying it. To obtain it pure, mix the fresh white juice with 4 or 5 times its weight of water; let it stand for a day and then heat, and skim off the layer of rubber that rises to the top. Repeat until all the gum is extracted, and then press between folds of cloth. You might mix this pure white gum with white lead, or similar body, to harden it, but the proper manufacture of what you seem to be looking for can only be attained by careful experiment. See Muspratt's "Chemistry," and Tomlinson's Encyclopœdia, article caoutchouc.

Mrs. H. H. asks: How can I make fibrin from albumen? Answer: Put the whites of a dozen eggs in a gallon of water. Let them soak for 12 hours, and then raise the same water containing the eggs to the boiling point. Continue the boiling for 10 or 15 minutes.

W. E. T. asks: Are not lightning rods much safer conductors if perfectly insulated? Answer: The rod should be attached directly to the house without insulators.

H. W. S. asks: What is the general rule for calculating solar and lunar eclipses, and what is the best text book on the subject? Answer: Eclipses of the sun and moon recur every eighteen years, eleven and one third days, in nearly the same order. They occur whenever a lunar conjunction or opposition coincides with one of the moon's nodes. See Burritt's "Geography of the Heavens," pp. 214-224, or Chauvenet's "Spherical and Practical Astronomy," pp. 436-521.

A. S. asks: 1. What is the best kind of a battery to attach to a steam boiler to prevent lime from sticking to it? 2. What is your opinion of using an electric current to prevent scale from forming in boilers? I have seen batteries used for that purpose, and hear them highly spoken of. Answers: 1. One that is constant, such as Leclanche's and Daniell's sustaining battery. 2. We should think, having no positive evidence to the contrary, that so much battery power would be required to do efficient service that it would hardly pay.

W. A. B. says, in answer to A. D. W., who asked how to deposit a thin film of lead on iron: Dissolve the acetate or nitrate of lead in water. Precipitate the lead with a strong solution of carbonate of potassa, adding it drop by drop till no further effect is produced. Pour off the supernatant liquid, and wash several times in water, and then add a solution of cyanide of potassium, say two ounces to the gallon of water, to redissolve the precipitate. By employing this solution in a weak state, with moderate battery power, I have coated articles admirably. The iron must be well cleaned in a pickle.

O. C. says, in reply to O. C. W.: I would say that high water is the easiest to make steam with. If any one doubts this, let him run his boiler, say one day with water between the lower and middle gages, and the next day with water above the top gage, and he will see which is the easier.

J. E. C. asks: Which is the best water for drinking and household purposes: water obtained from a drive pipe well, or by the common well, providing that the latter is cemented up from 5 feet from the bottom, both having the same kind of pipe and pump? Answer: Whether the water be obtained from a drive pipe well or an ordinary one will make no difference as regards the quality of the water for household or drinking purposes, other things remaining the same.

W. B. asks: What can I use to remove ink stains from a pair of tweed trousers? Answer: Rub a little melted tallow on the spot, and then wash; or apply lemon juice, or a little powdered cream of tartar made into a paste with hot water.

B. H. B. says: In your issue of June 14, you give a mode of tinning hooks and eyes, pins, etc. I wish to apply the process, and I ask for the proportion of the ingredients of the recipe. Answer: You can tin articles of iron by first dipping them into dilute oil of vitriol to clean their surfaces and then into a bath of melted tin.

J. S. B. asks: What is paint or plumbago mixed with to make a composition fit for filling pencils? Answer: The plumbago used in lead pencils is generally mixed with clay and moistened with water, then pressed into the form desired.

E. asks: How can mold stains be removed from books without injuring the paper? Answer: You can whiten papers discolored with mold in the following way: 1. Wet with pure clean water. 2. Soak in a dilute solution of bleaching powder. 3. Pass through water made sour to the taste by muriatic acid. 4. Soak in pure water until all traces of acid are removed, and dry. It is not necessary to say that this operation requires careful manipulation. You may try, instead, exposing the moistened paper to the fumes of burning sulphur, which is a good bleaching agent, and then passing it through water and drying.

T. S. asks: How can I make the portable ink of Professor Bottger, described by you in your issue of March 1? Answer: Make the strongest possible solution of aniline black in water or alcohol. Soak thick unsized paper thoroughly until it is as dark as the solution, and then dry.

J. G. says: I have broken about two dozen of good new files. How can I fix them? Can they be soldered in any way? Answer: You might secure the pieces for use upon a wooden bar. We think you could not solder them.

D. S. H. asks for a formula for calculating the power of a falling weight. Answer: Theoretically, the work done by gravity equals the distance the weight falls multiplied by the weight. The mean pressure on the pile is equal to the work, divided by the distance the pile enters in feet. Example: Suppose the weight is 2,500 pounds, and falls 25 feet, forcing the pile into the ground 18 inches. Work of weight = 2,500 × 25 = 62,500 foot pounds. Mean pressure on pile = 62,500 ÷ 1½ = 41,666⅔ pounds.

L. M. C. asks: What will be the best cement formica, to stand a good heat, such as that of a lamp? Answer: The following is a recipe for a fireproof cement for mineral substances: Fine river sand 20 parts, litharge 2 parts, quick lime 1 part, linseed oil to form a thin paste. Let it harden before applying heat.

S. D. E. asks: What is the proper focal distance for a 2 foot reflector, and how large should the small reflector be to correspond? Answer: A two foot reflector should be of 20 feet focus, that is, the radius of curvature should be 40 feet. The plane mirror should be about 3 x 5 inches. See page 43 of our current volume.

E. J. L. says: 1. Suppose a half inch pipe is inserted in the end of a barrel, the pipe extended to a perpendicular hight of 33 feet, and water poured in till full; will there be sufficient pressure on the pipe to burst the barrel? 2. What will be the pressure, and what is the rule to ascertain the pressure? 3. If a one inch pipe is placed instead of the above pipe, at the same hight, will there be any difference in the pressure? If any, how much? Answers: 1. It will be nearly correct to estimate the water pressure at half a pound per square inch for every foot in hight of the water column. Whether your barrel will stand the pressure of a water column 33 feet high depends on its strength. 2 and 3. The pressure on the barrel would be about 15 pounds to the square inch.

D. M. says: On page 75 of your current volume, I. M. R. asks why the images of objects, being reversed upon the retina of the eye, are yet apparent to us in their proper positions "May I ask I. M. R. if he knew, before he studied natural philosophy, that there was upon the retina of his eye an image of objects seen by him? It will, I think, be readily granted that the object of vision is not the image upon the retina, but the thing of which it is the image. In other words, what the faculty of sight apprehends is the external object, not the image of it upon the retina. This image is, not the object of the faculty, but the means by which the faculty elicits the act of seeing; not that which we see, but that by means of which we see. If the spectator is not conscious of the image upon the retina of his eye, if he has no knowledge of it in the act of vision, then the difficulty proposed by I. M. R. vanishes; for that difficulty arises from his assuming that what we see is the image upon the retina, while in fact no man has a direct knowledge of that image, but only a reflex knowledge, acquired by studying natural philosophy. I.M.R. should have asked: Why, the images of objects being reversed upon the retina of the eye, we nevertheless see the objects in their proper positions? The question thus laid down presents no serious difficulty.

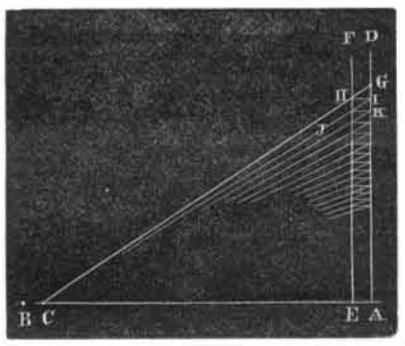
I. G. points out, in reply to J. E. E.'s question as to the phosphorescence from fire flies and glow worms, that the light is only emitted by the females during the copulating season.

D. B. M. says, in answer to several inquiries as to how to determine the meridian of any locality: On some clear night, suspend two plumb lines at any convenient distance apart, and align them as exactly as possible with the pole star. Twelve hours afterward observe them again, when, without the merest chance, they will not be in alignment with the star. Align them again by moving either of the lines to the east or west as may be necessary. The first position of the line moved should be carefully marked before moving it. Find the middle point between the first and second positions of the line moved, suspend the moved line at this point, and the two lines will hang in a true meridian line. Of course this method can be used only when the nights are somewhat more than twelve hours long. A lantern, properly shaded, will be found useful in making the alignments. A moonlight night is not very suitable, because the star is not then so distinct. Trouble will sometimes be caused by the wind. This may be very much lessened by allowing each plumb to hang in a vessel full of water.

W. A. B. says that a piece of brown paper, folded two or three times and placed between the upper lip and the gums, will immediately arrest bleeding at the nose. Press the lip gently with the finger so as to hold the paper firmly. It never fails.

O. C. says: I would suggest to A. K., who asks for an invisible ink, that sulphuric acid greatly diluted with water will be invisible until gently heated, when it will become a jet black, if rightly proportioned. If too much acid is used, it will eat the paper.

J. E. S. says, in reply to J. H., who asked for a rule to determine the position of the frets on the finger board of a guitar: The following is available for ordinary use: Divide the length of the string from nut to bridge into eighteen equal parts; take one of these parts for the space between nut and first fret. Then divide the distance between that fret and the bridge into eighteen parts and take one of those for the second fret, and so on, always shortening the string one eighteenth to raise the pitch a half tone. This, if accurately spaced, will bring the octave fret a little below the center of the string, which is as it should be to produce a perfect octave; for although the absolute center is the point for the harmonic, the string, being in higher tension when forced on to the fret, gives too high a tone if the fret be in the center. To space for the frets with compasses in the ordinary way, if done with any degree of accuracy, is a slow and tedious job, but by adopting the



method shown in figure, it will become simple and interesting. Upon a drafting board, with square and straight edge, make the base line A B some three or four feet long; set a pin at the point C and erect two perpendicular lines A D and E F, which shall be one eighteenth of the distance from A C apart, that is, if it is 36 inches from A to C, then from A to E will be 2 inches. Lay off on the line A D the length of the guitar string as at C, and with the straight edge strike the diagonal G C; from the intersection H draw the horizontal I, which gives the position of the first fret. The diagonal J and horizontal K give the position of second fret, and so on to full number. The finger board spaced in this way will not be likely to correspond exactly with the finger boards on the guitars made by regular makers, nor do those of different makers agree, from the simple fact that any instrument that makes the same tone for the sharp of one note and the flat of the next is an imperfect instrument, as there should be something like a quarter or third of a tone difference; so when a single tone is used for the two, it is but a compromise at best, and the compromise made by the regular spacings is as good as any, for the difference is so slight as not to be discernible by the ordinary ear. If one has a guitar of which the location of the frets is satisfactory and wishes to transfer the same proportions to another, where the finger board is either longer or shorter, the use of this same triangular draft is available and perfect. Make the triangle as above, only move the two vertical lines until their lengths shall correspond with the two different lengths of strings, transfer this portion of the frets on to one of the lines, and draw the diagonals, which will give the other.

MINERALS, INSECTS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated:

S. H. C., to whom we submitted certain minute insects, found as parasites on the common fly (sent to us by another of our correspondents), reports that he has examined the specimens under the microscope. He also sends us sketches of their appearance under the instrument, with descriptions. From the natural size, less than half the diameter of the head of a pin, our correspondent has magnified them up to formidable looking monsters six inches in length. He states that they belong to the group *acaridea*, and are probably members of the fourth family, or *hydrachnida*.

A. F. S.—The bright brassy crystal is iron pyrites, or sulphide of iron.

C. O. T.—All three are iron pyrites, a compound of sulphur and iron, of value when in sufficient quantity for the manufacture of oil of vitriol.

K. J. J.—The black specimen appears to be slate. The other specimen contains plumbago.

G. W. A.—The metal looks like zinc.

R. S.—Your specimen is probably the humming bird moth, which is often mistaken for the bird.

R. H. McG.—The metallic specimen seems to be an alloy of silver and lead; the other material is bituminous coal.

J. M.—The article enclosed is a kind of grass which has certainly taken on a hue of wondrous green, derived from the spent products of the dye house in which it was found.

E. A. S.—Iron pyrites.

J. S. T.—The enclosed specimens are iron pyrites, of value if in large quantities and near transportation.

J. A. E—Your mineral resembles oxide of iron. An analysis will cost $10.

J. R. W.—The metallic composition of this mineral can be determined only by a careful assay. Cost $10.